OPERATION & MAINTENANCE HANDBOOK

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MODEL P902

PLUG-IN OUTPUT UNIT

INSTRUMENT REGISTRY
Serial No.

BAYTRON SYSTEMS CORP.
1720 Newport Circle
Santa Ana, Calif. 92705

SYSTRON-DONNER CORPORATION

DATAPULSE

10150 W. Jefferson Blvd., Culver City, Calif. 90230
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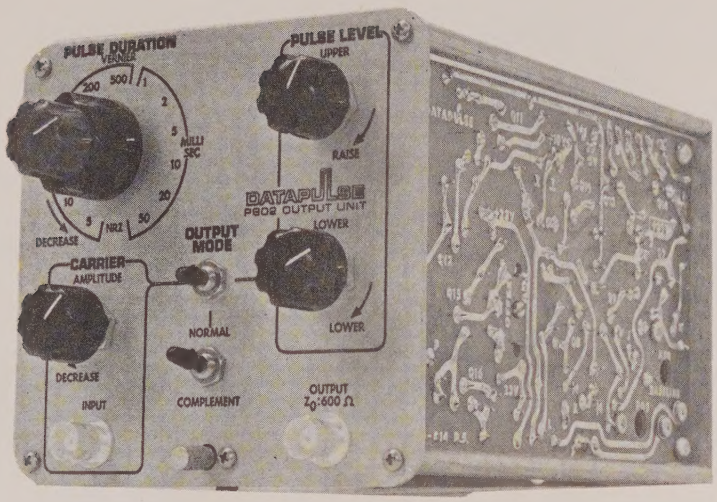

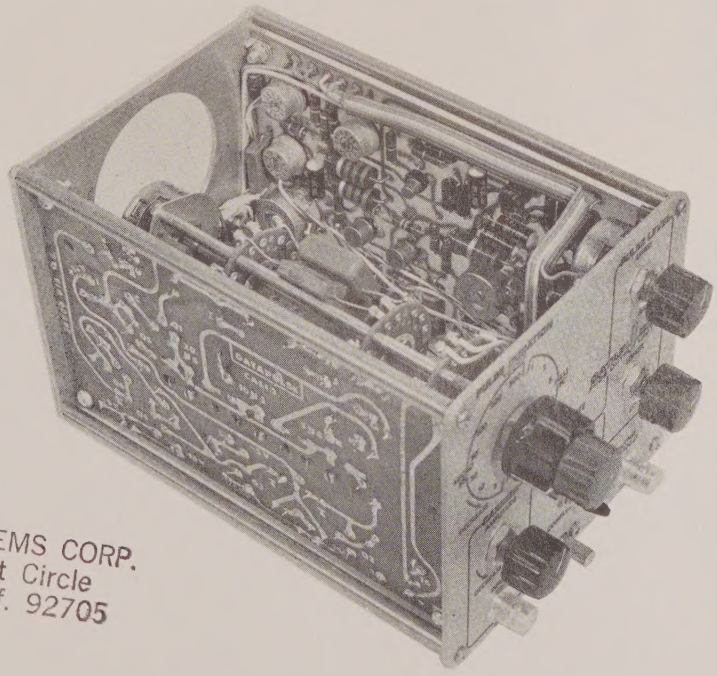

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P902 PLUG-IN OUTPUT UNIT

The P902 Plug-in Output Unit is designed for use with DATAPULSE Model 200, 103 and 202 test instruments. The P902 features pulse or modulated sine wave outputs, with 600 ohms output impedance, and with independent controls for upper and lower pulse amplitude levels and carrier amplitude.

This manual provides detailed instructions for the use and maintenance of your Model P902. A thorough understanding of its contents will contribute to full utilization and longer life of this unit.

SECTION I

SPECIFICATIONS

1.1 INPUT TRIGGER REQUIRED

Neg. 2 volt pulse from 100 ohm source, 10 nanosec. rise time, 20 nanosec. wide.

1.2 OUTPUT PULSES

Either variable DC level pulses or modulated carrier outputs are available, direct coupled around ground with 600 ohms output impedance. Selection of type of output is made by output mode switch.

1.2.1 Pulse Duration, or On-time of Carrier Output

Continuously variable from less than 2 μsec. to 50 millisec., covered in 13 steps (1, 2, 5 series) plus uncalibrated vernier. Also provides non-return to zero output when used with 200 series instruments. Step control accuracy is approximately 10%. Circuit recovery time allows operation up to at least 50% duty cycle.

1.2.2 Normal-Complement Switch

Allows changing of output format to its logical complement (i.e., pulse levels are reversed or carrier output "on" and "off" times are reversed).

1.2.3 Pulse Output

Upper and lower pulse levels are independently variable from 1 volt to 15 volts and -1 to -15 volts, respectively, open circuit. Rise and fall times are approximately 0.1 μsec.

1.2.4 Carrier Output (On-Off Modulated)

0 to 20 kc allowable input frequency. Amplitude is variable 0 to 16 volts P-P with a 40 volt P-P sine wave input. (Output amplitude is approximately 40% of input amplitude.)

1.2.5 External Carrier Input Impedance

Approximately 25 K ohms.

1.3 POWER REQUIRED

+10v, -10v, -5v, ±23v*, and ±30v*.

All power required is available from standard DATAPULSE plug-in type instruments. Voltages marked * are available only from instruments incorporating Modification M (designated by suffix M on model numbers stamped on rear nameplate). This modification may be added to basic instruments by the installation of Modification Kit M901, available as an accessory.

1.4 CONSTRUCTION

Light gold anodized front panel with etched black and red markings. Plugs into space provided in standard DATAPULSE instruments, mating with 24 contact Blue Ribbon female connector. Front panel output connectors are BNC type. Size is 4 3/8" H x 4 3/4" W x 6 9/16" D.

1.5 ACCESSORIES

Furnished with one operation and maintenance manual section for insertion in basic instrument manual. The following accessories are available: Modification Kit M901 (for incorporation of Modification M in basic instruments), coaxial cables.

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SECTION II

OPERATING INSTRUCTIONS

2.1 DESCRIPTION OF CONTROLS AND CONNECTORS

2.1.1 Pulse Duration, Vernier

Controls the output pulse width (carrier "on" time). Step calibration is made at the factory with the vernier control turned fully clockwise.

2.1.2 Pulse Level

2.1.2.1 Upper: Controls the upper voltage level of the output waveform when the pulse level mode is selected.

2.1.2.2 Lower: Controls the lower voltage level of the output waveform when the pulse level mode is selected.

2.1.3 Carrier

2.1.3.1 Amplitude: Controls the amplitude of the modulated carrier output when a carrier (sine wave) is fed into the INPUT BNC connector.

2.1.4 Output Mode

Selects either pulse level or modulated carrier as an output format.

2.1.5 Normal-Complement

Allows changing of output format to its logical complement (i.e., pulse levels are reversed or carrier output "ON" and "OFF" times are reversed).

2.2 PLACING IN OPERATION

Plug the P902 in and turn the power switch ON.

Make sure the spacing of the input triggers is not less than approximately twice the pulse width as set on the Pulse Duration Switch.

Observe the output waveform and vary the controls, observing their operation as explained in Paragraph 2.1 of this manual.

If the P902 seems to be operating improperly, refer to the Troubleshooting Procedure in this manual.

2.3 OPERATING CONSIDERATIONS AND SPECIAL APPLICATIONS

2.3.1 The output circuitry in the P902 has been designed so that shorting the outputs to ground will not be injurious to the unit.

The outputs of two or more P902's may be mixed together directly.

2.3.2 Coherent Tone Bursts

By externally clocking the 200 or 202 data generators from a sine wave source, providing the same source as the carrier input to a P902, and setting the P902 for NRZ operation, single sine wave cycles are coherently controlled by programming the word generator.

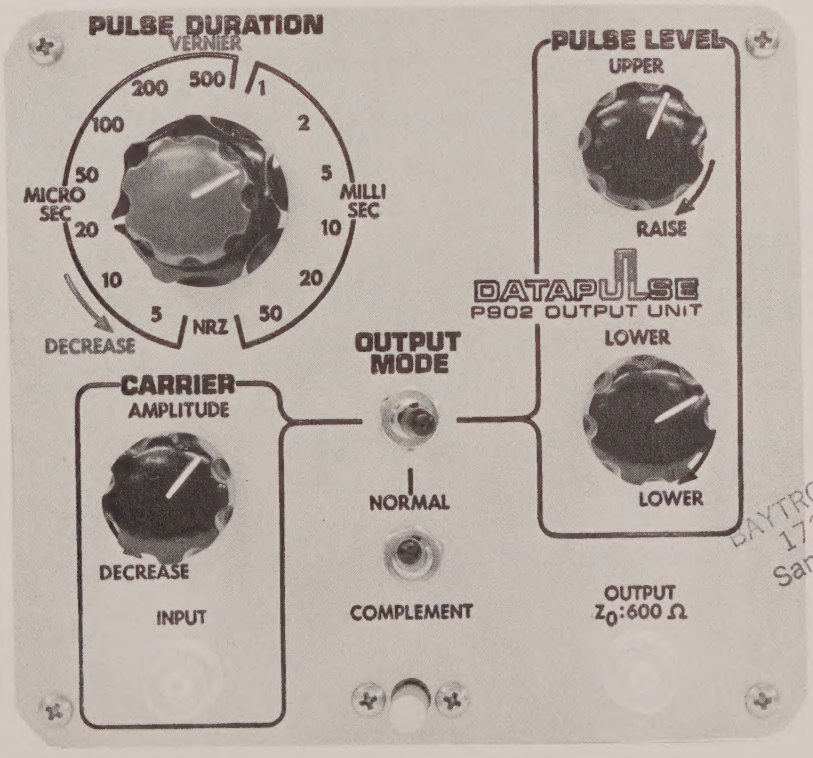

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FIGURE 2-1. CONTROLS AND CONNECTORS

SECTION III

THEORY OF OPERATION

3.1 BLOCK DIAGRAM DESCRIPTION

Consider the P902 as four basic circuits:

(1) A Pulse Width Gate Generator

(2) A Carrier "On-Off" Modulator

(3) A Pulse Amplifier

(4) An Output Amplifier

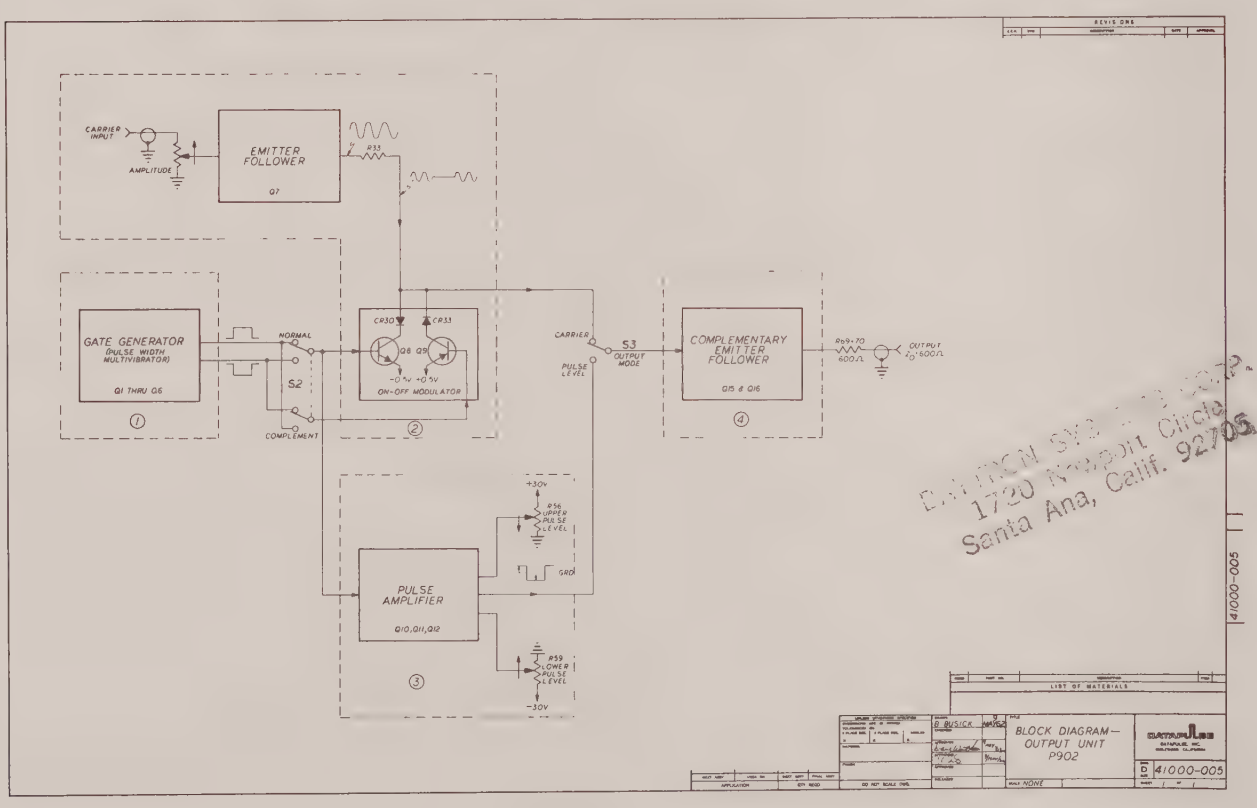
The pulse width gate generator consists of a monostable multivibrator with emitter follower cross-coupling on one side to improve the gate output waveshape.

In the modulator section, Q8 and Q9 are used as switches to "short" the sine wave carrier input to ground when pulsed by the gate generator.

Diodes CR-30 and CR-33 are used to prevent the collector-base diode forward conduction in Q8 and Q9 from affecting circuit operation. The baseline calibration adjustments are used to offset the saturation voltage on the transistors and the forward conducting voltage drop on CR-30 and CR-33.

The pulse amplifier section consists of two level-shifting inverters and a saturating, switching inverter, Q12. The amplitude on the upper and lower pulse levels is controlled by adjusting the power supply voltages on this inverter.

The complementary emitter follower output stage is a conventional design with the addition of offset biasing of the transistor's emitter to base operating voltages.



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SECTION IV

MAINTENANCE INSTRUCTIONS

4.1 PREVENTIVE MAINTENANCE

4.1.1 Recalibration

The P902 contains very stable circuitry and the unit will provide many hours of trouble-free operation. To insure continued reliability, the offset adjustments, power supply voltages, and pulse width circuitry should be checked for calibration after each 500 hours of operation, or at least every six months if the unit is used intermittently.

4.1.2 Visual Inspection

Conduct visual inspections at regular intervals, preferably every few months. Check for possible circuit defects including loose or broken connections; scorched printed circuit boards, wires, or resistors; and loose nuts and bolts.

4.1.3 Component Replacement and Soldering Connections

When replacing transistors, diodes, or other heat-sensitive devices, a heat sink should be used between the device and the soldering iron tip. A pair of long-nosed pliers may be used in most cases. Special care must be taken, when soldering printed circuit wiring to avoid overheating and subsequent separation of the printed circuit from its epoxy material.

4.2 TROUBLESHOOTING PROCEDURE

The first points to check after most malfunctions are the power supply voltages.

The voltages used for the P902 should be adjusted to within ± 5% of their specified value. Note that most of the voltages must be adjusted in a certain sequence due to referencing.

The sequence which must be used is as follows:

(1) +10v
(2) -10v
(3) -5v
(4) -23v
(5) +23v
(6) any of the others

The following table should prove useful in isolating malfunctions within the unit. Once the area of trouble is isolated, the waveform photos and schematic diagrams in this manual may be used to locate the defective components.

TABLE 4-1

TROUBLESHOOTING CHECKS

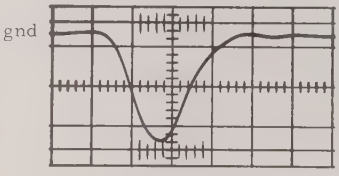
MALFUNCTION	POSSIBLE CAUSE
NO OUTPUT (BOTH MODES) (W12)	
Check for	Output emitter followers Q15, Q16
NO NEGATIVE OR POSITIVE GATES	
Check for	1. Check for absence of input trigger. 2. Multivibrator inoperative: Q1, Q2, Q3, Q4, Q5, Q6. Check waveforms W1 through W5.
IMPROPER OUTPUT (PULSE LEVEL MODE ONLY) (W6, W7, W8)	
Check for	1. Amplifiers Q10, Q11, Q12. 2. Emitter follower voltage sources Q13, Q14.
IMPROPER OUTPUT (MODULATED CARRIER MODE ONLY) (W9, W10, W11)	
Check for	1. No carrier input. 2. Emitter follower Q7. 3. Modulators Q8, Q9.

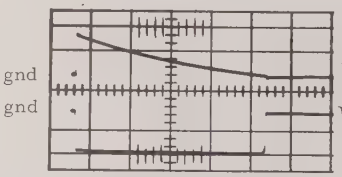
MAINTENANCE INSTRUCTIONS

TABLE 4-2

CHARACTERISTIC WAVEFORMS

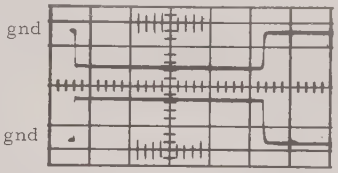
The waveforms shown here should prove useful during troubleshooting. These photographs were taken with a Tektronix Type 541 Oscilloscope with a Type CA dual trace plug-in unit. The location description for the waveforms are in reference to the schematic diagram in the rear of this manual (Dwg. J40 000-012).

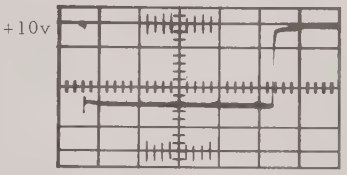


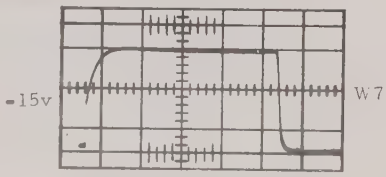


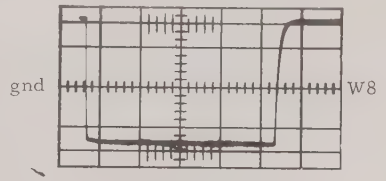
Top: Trigger Input (Set or Reset). 20 nanosec./div.; 1v/div.
Bottom: W3 - Base of Q3; W4 - Collector of Q3. 1 μsec./div.; 5v/div. Pulse Duration control on 5 μsec.

Top: W4A - Emitter of Q5; W5 - Collector of Q6. 1 μsec./div.; 5v/div.
Bottom: W6 - Collector of Q10. 1μsec./div., 2v/div. Front Panel Controls: Logic Switch on NORMAL; Pulse Duration on 5 μsec.

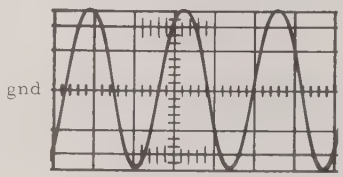


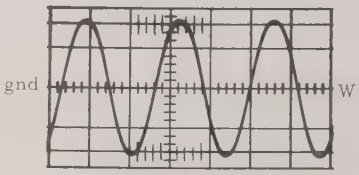






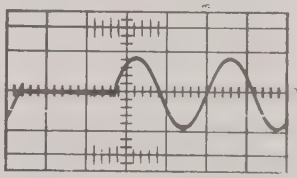
Top: W7 - Collector of Q11. 1μsec./div.; 2v/div.
Bottom: W8 - Collector of Q12. 1μsec./div.; 10v/div. Front Panel Controls: Pulse Duration on 5 μsec.; Logic Switch on NORMAL; Output Mode on PULSE LEVEL; and Pulse Level Controls fully cw.

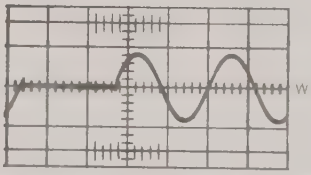


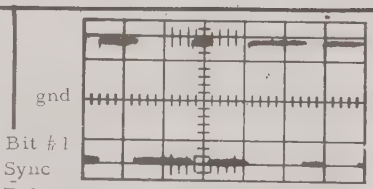


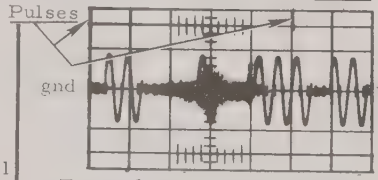
Top: W9 - Carrier Input. 20 μsec./div.; 10v/div.
Bottom: W10 - Emitter of Q7. 20 μsec./div.; 10v/div. Front Panel Controls: Carrier Amplitude fully cw.

Top: W11 - Junction of CR30 and CR33. 20 μsec./div.; 10v/div.
Bottom: W12 - Output. 20 μsec./div.; 10v/div. Front Panel Controls: Pulse Duration on 50 μsec.; Logic Switch on NORMAL; Carrier Amplitude cw; Output Mode on CARRIER (40v P-P Sine Wave Input).









Top and Bottom: W12 Output. Waveforms show N.Z. programmed outputs of logic level and carrier.
Program: 1011 000 10011 (12-bit word).
Front Panel Controls: Logic Switch on Complement. Waveforms were obtained by triggering a Model 200 Data Generator with a synchronous pulse to the sine wave shown.

4.3 CALIBRATION PROCEDURE

4.3.1 Equipment Required

DC Oscilloscope -- Tektronix 541, Hewlett-Packard 150A, or equivalent.

DC Voltmeter -- Any voltmeter with greater than 100 ohms per volt sensitivity, calibrated to ± 5%.

4.3.2 Power Supply

The power supply (and adjustments thereto) for the P902 are located in the instrument with which the P902 is used. The adjustment sequence which must be followed is noted in Section 4.2 of this manual.

4.3.3 Pulse Duration

On the left-side printed circuit card of the P902 there are three screwdriver-adjust controls, labeled 20 μs, 10 μs, and 5 μs.

Set the oscillator switch in the main instrument to 1 kc or less and the pulse delay for minimum delay.

Set the pulse duration switch to 5 μsec. and turn the vernier control fully clockwise. Leave it there throughout the rest of the calibration.

Observe the pulse level output and adjust the 5 μs calibration control for 5 μsec. pulse width.

Turn the pulse duration switch to 10 μsec. and adjust the 10 μs calibration control for 10 μsec. pulse width.

Turn the pulse duration switch to 20 μsec. and adjust the 20 μs calibration control for 20 μsec. pulse width.

This completes the pulse duration calibration.

4.3.4 Output Baseline and Offset Adjustment

On the right-side printed circuit board of the P902, there are 2 screwdriver adjust controls labeled "NEG" and "POS" Baseline.

Adjust both controls fully cw.

On the same card there is a screwdriver adjust control labeled "OFFSET ADJ."

Throw the Output Mode Switch to "CARRIER."

Turn the Carrier Amplitude Control fully ccw.

Adjust the Offset Adj Control so that Output dc levels during the ON and OFF times are equal (vertical scope sensitivity = 0.5v/cm).

4.3.5 Baseline Calibration Adjustments

Turn POS and NEG Baseline fully cw. Adjust offset for straight line (same dc levels on and off).

Throw the output mode switch to "Carrier".

With a carrier being fed into the input BNC connector, turn the amplitude control clockwise.

Turn either the NEG. or the POS. baseline control to mid-position and adjust the other control for zero "output" volts DC during the time the carrier is modulated "off".

This completes the P902 calibration.

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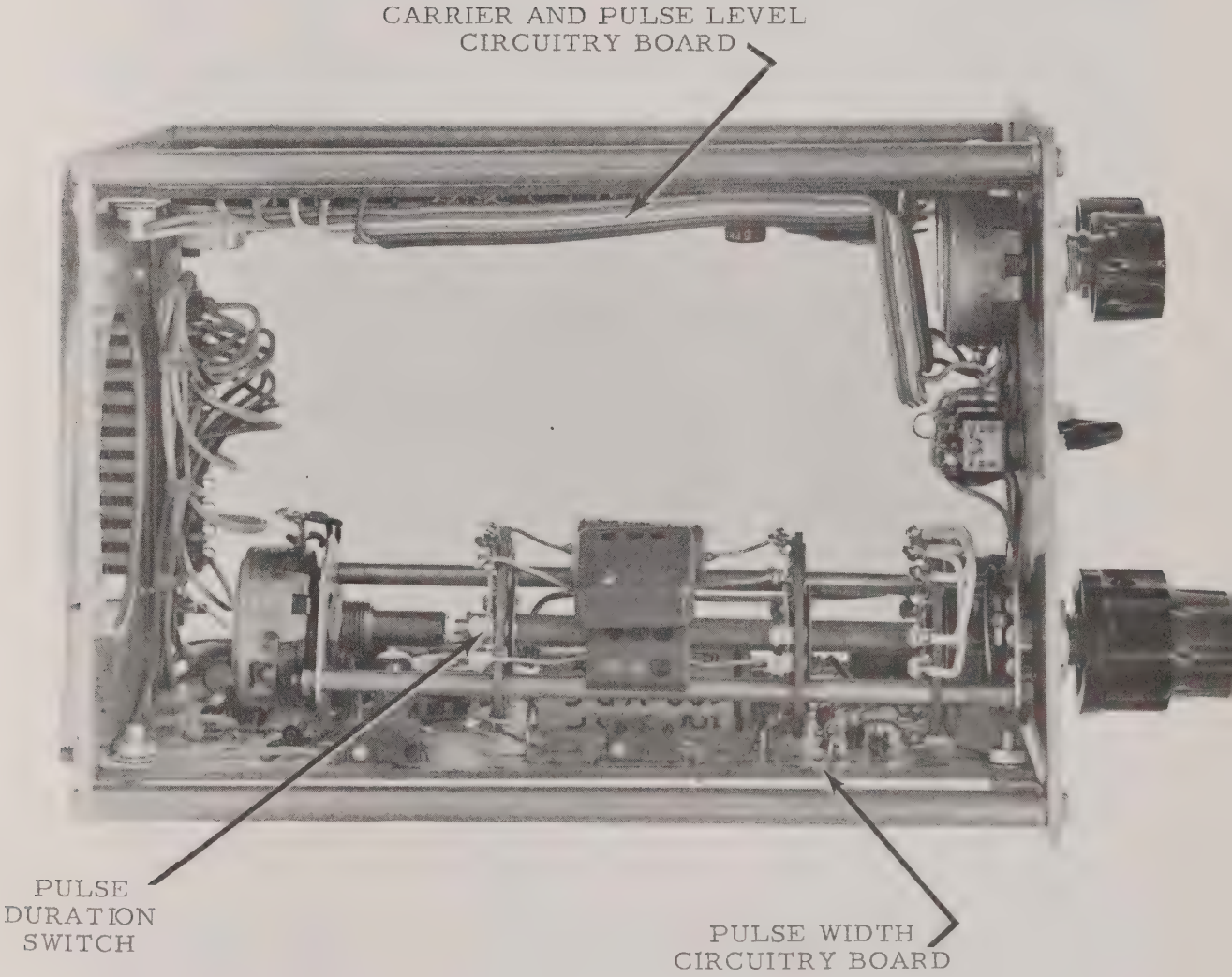

FIGURE 4-1. P902 TOP VIEW

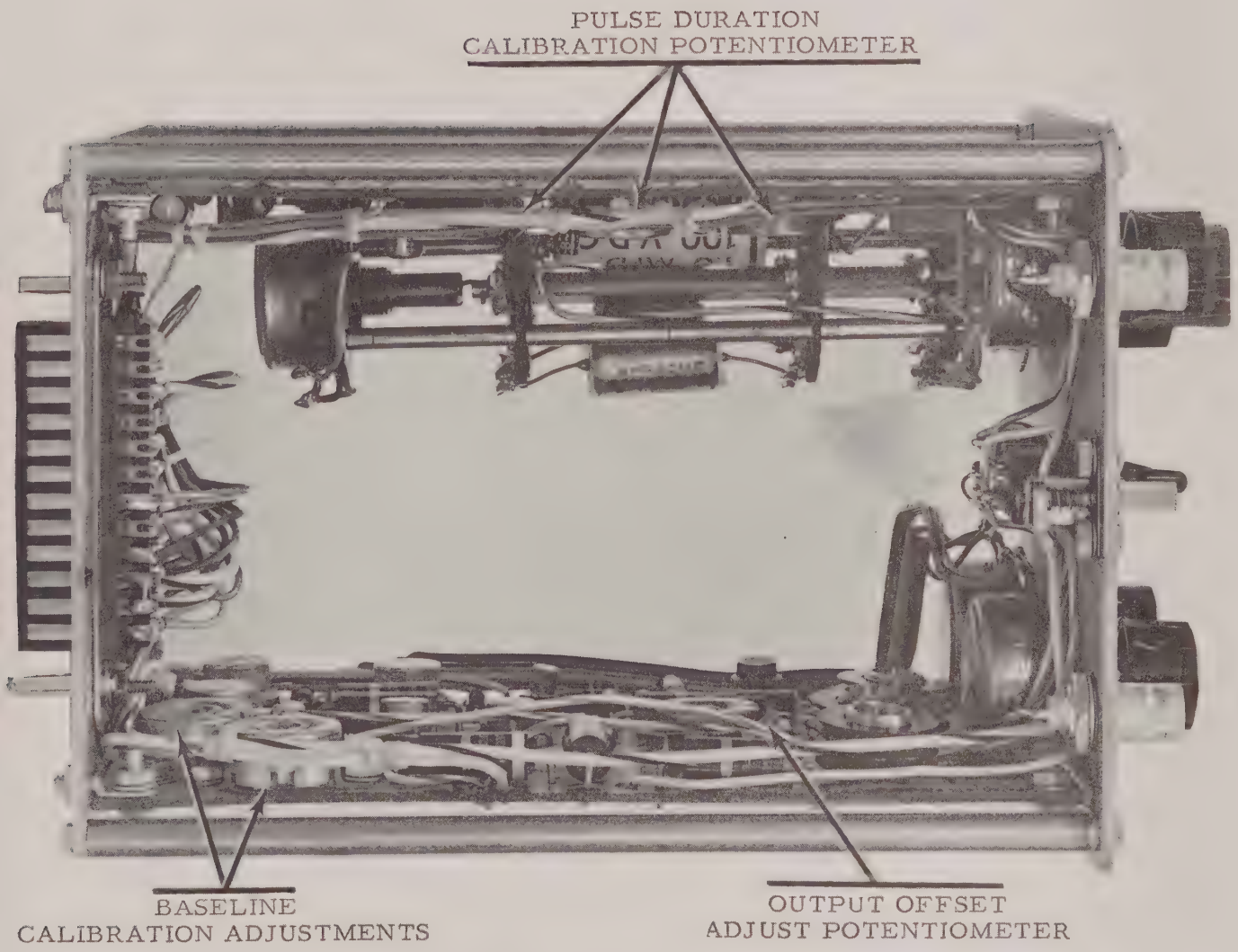

FIGURE 4-2. P902 BOTTOM VIEW

4.4 SPECIFICATIONS VERIFICATION

Allow a 30 second warm up period before making tests. The following equipment, or its equivalent, is necessary -

a) A 100 kc trigger source, with ±10v, ±23v, ±30v, and -5v at required currents. (Datapulse Models 200M or 202M). Model 103M is not capable of testing the NRZ operation but may be used with this limitation in mind.

b) Syncroscope (Tektronix 543 with Type L Single Trace Preamplifier).

c) 600 ohms, 1 w resistor.

d) Sine wave generator (Hewlett-Packard 200AB).

4.4.1 Pulse Duration Plug the P-902 into either receptacle provided for it in the parent unit.

Turn power on.

Set CLOCK (REPETITION) RATE to 10KC/S (Vernier cw).

Set all program switches on the 200 or 202 to the up (one) position.

Set PULSE DELAY to 0.2 MICROSEC, VERNIER ccw.

Set PULSE DURATION to 5 MICRO SEC, VERNIER ccw.

Sync scope from the sync output of the main instrument (Clock or Reference Sync).

Throw OUTPUT MODE switch to PULSE LEVEL.

Throw NORMAL-COMPLEMENT switch to NORMAL (up).

Turn PULSE LEVEL, UPPER and LOWER controls fully cw.

View the pulse output at a Sweep Speed of 1μsec/cm and vertical sensitivity of 10v/cm.

See Pulse Duration Settings (Table 4-3).

4.4.1.1 NRZ Operation: Set program switches 1 and 3 to the down (zero) position (use the program switches which correspond to the channel output being used).

Set Clock Rate to 1KC/S. VERNIER cw.

Sync Scope on Bit One Sync output.

Set PULSE DURATION to NRZ.

Set PULSE DELAY Vernier fully ccw. (Actuate the ZERO DELAY switch).

Set scope sweep speed to .2msec/cm.

Verify a negative pulse 5cm wide after a delay of 5cm (±10%).

Set CLOCK RATE to 2MC/S, VERNIER cw.

Set sweep speed to -.2μsec/cm.

Verify two successive positive pulses approx 2 cm wide (±1cm).

Verify that the second pulse disappears when the number 3 switch is thrown to the up (one) position.

Program the number 1 and 3 switches to the up (one) position so that now all switches are in the same position.

4.4.1.1 Duty Cycle: Set scope sweep speed to 1μsec/cm.

Set CLOCK (REPETITION) RATE to 0.2 MC/S, Vernier ccw.

Set PULSE DURATION to 10 MICROSEC, VERNIER ccw.

Line up the leading edge of the pulse with the far left side of the scope graticule.

Turn the PULSE DURATION vernier cw until the leading edge of a second pulse lines up with the right hand side of the scope graticule (50% duty cycle).

Verify that less than 5% change occurred in the pulse width of the first pulse when the above adjustment was made.

4.4.2 Pulse Amplitude

Set CLOCK (REPETITION) RATE to 50KC/S, VERNIER cw.

Turn PULSE LEVEL, LOWER control fully ccw.

Verify a pulse amplitude of 1.6cm or more.

Turn PULSE LEVEL, LOWER control fully cw.

Turn PULSE LEVEL, UPPER control fully ccw.

Verify a pulse amplitude of 1.6cm or more.

Turn PULSE LEVEL, LOWER control fully ccw.

Set scope vertical sensitivity to 1 v/cm.

Set scope input to dc.

Ground the probe to establish a dc reference line.

Observe the output pulse.

Verify that the pulse base line and top are no more than one cm from the ground reference.

Throw the 'NORMAL-COMPLEMENT'

switch to 'COMPLEMENT.'

Verify that the pulse polarity reversed.

4.4.3 Carrier Modulation

Set scope vertical sensitivity to 10v/cm.

Apply a 40v peak-to-peak sine wave to the carrier input frequency -- 20kc/s.

Set scope sweep speed to 0.1msec/cm.

Set CLOCK (REPETITION) RATE to 1KC/S, VERNIER cw.

Set PULSE DURATION to 200 MICROSEC, VERNIER cw.

Set output mode switch to CARRIER.

Observe the P902 output.

Verify a gated sinewave, the envelope being approx 2cm duration.

Set scope vertical sensitivity to 5v/cm.

Verify that the envelope amplitude is greater than + or -1.6cm in amplitude using the "OFF" level as a reference.

Throw the NORMAL-COMPLEMENT switch to NORMAL.

Verify that the sinewave "OFF" and "ON" times are reversed.

4.4.4 Output Impedance

Apply a 600 ohm, 1w resistor between the output and chassis ground.

Verify that the amplitude is reduced 50% (±10%).

This concludes the Specifications Verification check.

TABLE 4-3.

PULSE DURATION CALIBRATION CHECK

CLOCK RATE (REPETITION RATE) (Vernier cw)	PULSE DURATION	VERNIER	SCOPE SWEEP SPEED (per cm)	CORRECT PULSE DURATION[1] (cm)	TOLERANCE (cm)
10KC/S	5μs	ccw	1μs	less than 2	----
10KC/S	5μs	cw	1μs	5.0	±0.5
10KC/S	10μs	cw	2μs	5.0	±0.5
10KC/S	20μs	cw	5μs	4.0	±0.4
10KC/S	50μs	cw	10μs	5.0	±0.5
1KC/S	100μs	cw	20μs	5.0	±0.5
1KC/S	200μs	cw	50μs	4.0	±0.4
1KC/S	500μs	cw	.1ms	5.0	±0.5
0.1KC/S	1ms	cw	.2ms	5.0	±0.5
0.1KC/S	2ms	cw	.5ms	4.0	±0.4
0.1KC/S	5ms	cw	1ms	5.0	±0.5
10 CPS	10ms	cw	2ms	5.0	±0.5
10 CPS	10ms	ccw	2ms	less than 2	----
10 CPS	20ms	cw	5ms	4.0	±0.4
10 CPS	20ms	ccw	5ms	less than 2	----
10 CPS	50ms	cw	10ms	5	±0.5

[1]Pulse duration is measured from the 50% amplitude point on the leading edge of the pulse to the 50% amplitude point on the trailing edge of the pulse.

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PARTS LIST

5.1 HOW TO USE THIS PARTS LIST

5.1.1 Reference Designations

Reference designations used throughout this listing correspond with reference designations given on component location photos and the following schematics:

Drawing No. 40000-012

Resistors are designated as R1, R2, R3, etc. and are fixed value, composition, 10% and 1/2 w unless otherwise noted.

Capacitors are designated as C1, C2, C3, etc. and are fixed value, 10%, 500v dc unless otherwise noted.

Diodes are designated as CR1, CR2, CR3; switches as S1, S2, S3; and inductors as L1, L2, and L3, etc.

5.1.2 Abbreviations

The following abbreviations are used:

CER	- Ceramic
DPC	- Deposited Carbon
ELECT	- Electrolytic
GMV	- Guaranteed Min. Value
MP	- Metalized Paper
M	- Mica
µF	- Microfarad
µh	- Microhenry
ms	- Millisecond
µsec	- Microsecond
ns	- Nanosecond
NPN	- Negative-Positive-Negative
OF	- Oil Filled
PT	- Paper Tubular
PNP	- Positive-Negative-Positive
SM	- Silver Mica
VAR	- Var.
VTQ	- Vitamin Q
WW	- Wire Wound

5.1.3 Federal Manufacturers Code Numbers

Manufacturers of the components used in this instrument are referenced herein by Federal Supply Code numbers as given in the October 1959 issue of Department of Defense Cataloging Handbook H4-1 and H4-2 and latest supplements, available from the Armed Forces Supply Support Center, Washington, D. C.

5.1.4 Lead Time

Lead time for all components listed is from stock to two weeks.

5.1.5 Shelf Life

Shelf life for all components listed is indefinite.

5.1.6 Effectivity

All components listed are effective with Serial No. 001.

5.1.7 Next Higher Assembly

There are no economically replaceable sub-assemblies therefore the next highest assembly for all components listed is the instrument.

5.1.8 Detailed Part Drawings

Parts listed are standard components for which detailed drawings are not required.

5.1.9 Repair/Overhaul Recommendations

Parts used are not economically reparable.

5.2 RESISTORS

REF. NO.	DESCRIPTION	MFR. AND MFR'S PART NO.	DATAPULSE PART NO.	QTY. USED	REC. SPARES	FED. MFRS. CODE	UNIT PRICE
R1	1 k	EB1021	10021-102	9	1	01121	.038
R2	3.3 k	EB3321	10021-332	5	1	01121	.038
R3	5 k, 0.2 w, 30% Linear	UPE 70	20240-502	2	1	71450	.584
R4	Same as R1						
R5	Var., 1 k, 0.2 w, 30% Linear	UPE 70	20240-102	2	1	71450	.47
R6	3.30 Ω	EB3311	10021-331	3	1	01121	.038
R7	Same as R3						
R8	2.2 k	EB2221	10021-222	2	1	01121	.038
R9	470 Ω	EB4711	10021-471	3	1	01121	.038
R10	100 Ω	EB1011	10021-101	5	1	01121	.038
R11	Var., 1 k, 2 w, Linear	JAIN056S102UA	20053-102	3	1	01121	.038
R12	Same as R6						
R13	Same as R1						
R14	Same as R2						
R15	Same as R2						
R16	Same as R1						
R17	220 Ω	EB2211	10021-221	4	1	01121	1.92

5.2 RESISTORS (Cont.)

REF. NO.	DESCRIPTION	MFR. AND MFR'S PART NO.	DATAPULSE PART NO.	QTY. USED	REC. SPARES	FED. MFRS. CODE	UNIT PRICE
R18	Same as R6						
R19	Same as R2						
R20	47 k	EB4731	10021-473	1	1	01121	.038
R21	1.5 k	EB1521	10021-152	1	1	01121	.038
R22	Same as R1						
R23 through R29 not used							
R30	Var., 25 k, 2 w, Linear	JAIN056S253UA	20053-253	1	1	01121	1.92
R31	Same as R1						
R32	4.7 k	EB4721	10021-472	1	1	01121	.038
R33	6.8 k	EB6821	10021-682	1	1	01121	.038
R34	Same as R1						
R35	10 k	EB1031	10021-103	1	1	01121	.038
R36	22 Ω	EB2201	10021-220	2	1	01121	.038
R37	470 Ω, 2 w	HB4711	10023-471	2	1	01121	.112
R38	Var., WW, 500 Ω, 2 w 20%, Linear	Series 112	10603-501	2	1	71450	.218
R39	Same as R37						
R40	Same as R38						
R41	Same as R36						
R42	33 k	EB3331	10021-333	1	1	01121	.038
R43	Same as R8						
R44	Same as R17						
R45	Same as R17						
R46	Same as R17						
R47	Same as R9						
R48	Same as R9						
R49	Same as R2						
R50	Same as R1						
R51	Same as R1						
R52	1 k, 2 w	HB1021	10023-102	1	1	01121	.112
R53	680 Ω	HB6811	10023-681	4	1	01121	.112
R54	Same as R53						
R55	47Ω, 1/2w, 10%		10021-470	1			
R56	Same as R11						
R57	680 Ω	EB6811	10021-681	3	1	01121	.038
R58	Same as R57						
R59	Same as R11						
R60	Same as R10						
R61	Same as R5						
R62	15 k	EB1531	10021-153	2	1	01121	.038
R63	Same as R10						
R64	Same as R53						
R65	Same as R57						
R66	Same as R62						
R67	Same as R10						
R68	Same as R53						
R69	1.2 k, 5%	EB1225	10011-122	2	1	01121	.076
R70	Same as R69						

5.3 **CAPACITORS**

C1	ELECT, 1 μF, 50v	EG-8-1-50-P	11152-105	8	1	37942	.2[illegible]
C2	Same as C1						
C3	SM, 27 μμF, 5%	RR1427	11017-270	2	1	00853	.10
C4	SM, 100 μμF, 5%	RR1410	11017-101	2	1	00853	.10
C5	Tantalum, 10 μF, 20v ±10%	150D-106X-902OB2	11511-106	1	1	56289	1.26
C6	Paper 0.1 μF, 100v, 10%, Mylar	D - WMF-1001	11085-105	1	1	09023	.60
C7	Paper, 0.1 μF, 200v, 10%, Mylar	Type 250	11093-104	1	1	14752	1.14

5.3 CAPACITORS (Cont.)

REF. NO.	DESCRIPTION	MFR. AND MFR'S PART NO.	DATAPULSE PART NO.	QTY. USED	REC. SPARES	FED. MFRS. CODE	UNIT PRICE
C8	SM, .01 μF, 300v, 1%	CRK3103F	11025-103	1	1	00853	1.13
C9	SM, 1,000 μμF, 1%	CR1210	11027-102	2	1	00853	.234
C10	Same as C3						
C11	Same as C4						
C12	SM, 47 μμF, 5%	RR1427	11017-470	1	1	00853	.10
C13	Same as C1						
C14	1000μf, 6vdc, Elect.	TVA1104	11150-108	1			
C30	Same as C9						
C31	Same as C1						
C32	SM, 220 μμF, 5%	RR1322	11017-221	1	1	00853	.10
C33	Same as C1						
C34	Same as C1						
C35	Same as C1						
C36	Same as C1						
C37, 38	Disc, 0.1 μf	841-01	11247-103	2	1	91674	.05

5.4 MISCELLANEOUS

CR1	Silicon, Mesa Computer 20 ns, recovery, 20 ma	DP 16-0	22164-000	5	1	15933	.40
CR2	Same as CR1						
CR3	Same as CR1						
CR4 through CR29 not used							
CR30	IN776, Germanium, Switching,	IN776	12144-000	2	1	14936	.50
CR31	Same as CR1						
CR32	Same as CR1						
CR33	Same as CR30						
S1	Rotary, 14 position	Oak	25250-008	1	0	81716	12.00
S2	Toggle, DDDT, Micro-Min.	Al	15280-002	1	1	95146	2.02
S3	Toggle, SDDT, Micro-Min.	Al	15280-001	1	1	95146	1.55
Q1	2N2375 Germanium, PNP	DP59-0	22595-000	1	1	94990	1.20
Q2	2N984 Germanium, PNP, Switching, 100 mw	DP46-1	22465-001	5	1	56289	1.90
Q3	Same as Q2						
Q4	Same as Q2						
Q5	Same as Q2						
Q6	Same as Q2						
Q7	2N1183B, Germanium PNP, 40v	2N1183B	12455-001	1	1	02735	4.78
Q8	2N1302 Germanium, NPN Switching	2N1302	12505-001	1	1	01295	.66
Q9	2N404 Germanium, PNP, Switching	2N404	12405-001	1	1	14936	.66
Q10	DP63-0 Silicon NPN, vhf Switching	DP63-0	22635-000	1	1	01295	1.36
Q11	SM1467 Germanium PNP	SM1467	12465-004	1	1	94990	2.30
Q12	Silicon, NPN, High Speed High Current	T2340	12685-002	1	1	98329	7.50
Q13	DP59-0 Germanium PNP Med. Pwr.	DP59-0	22595-000	3	1	73293	3.12
Q14	Same as Q13						
Q15	SM1330, Silicon NPN, 60 mc switching	SM1330	12685-00	1	1	94990	1.70
Q16	Same as Q13						

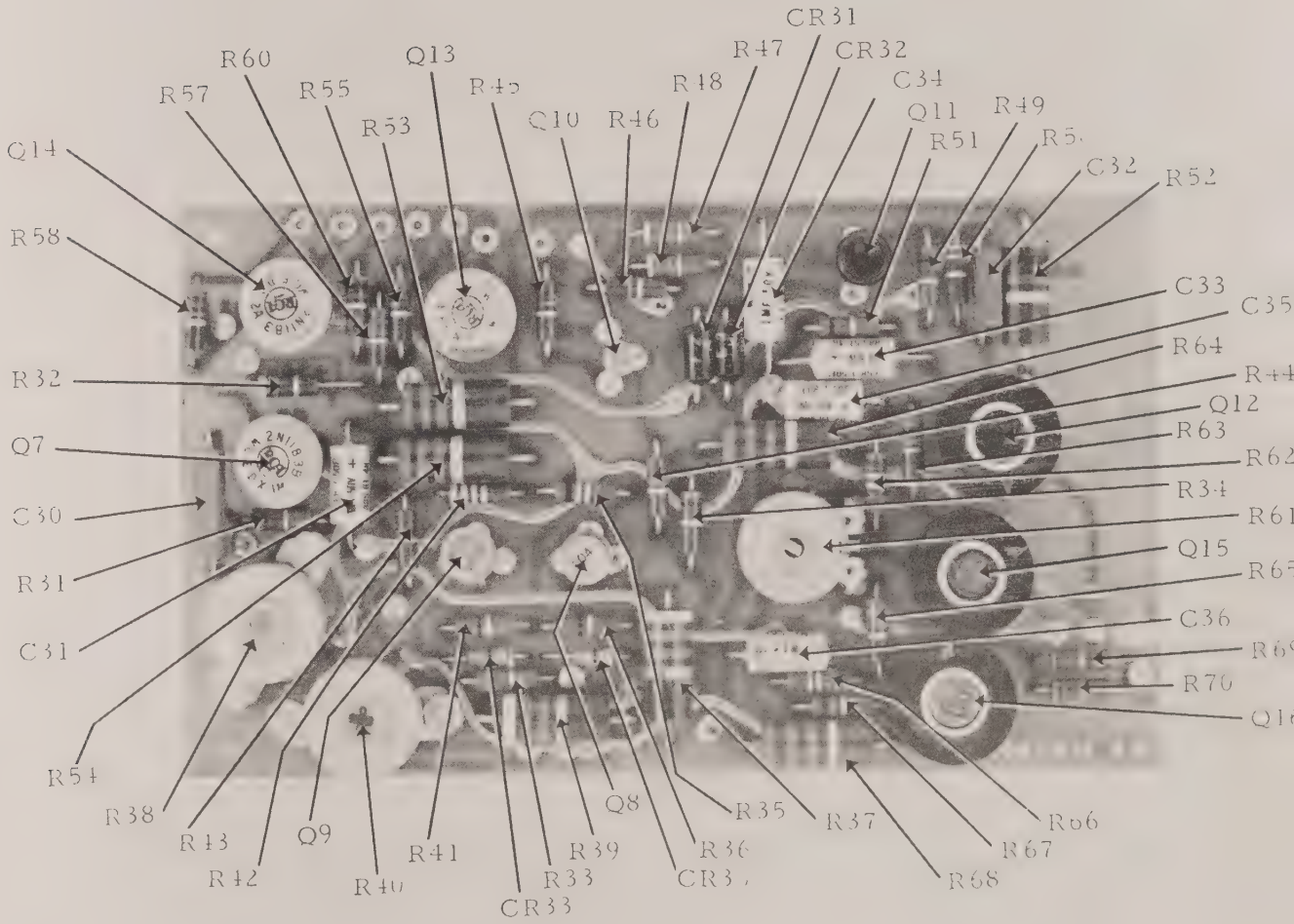


Figure 5-1. P902 Output Unit (right side).

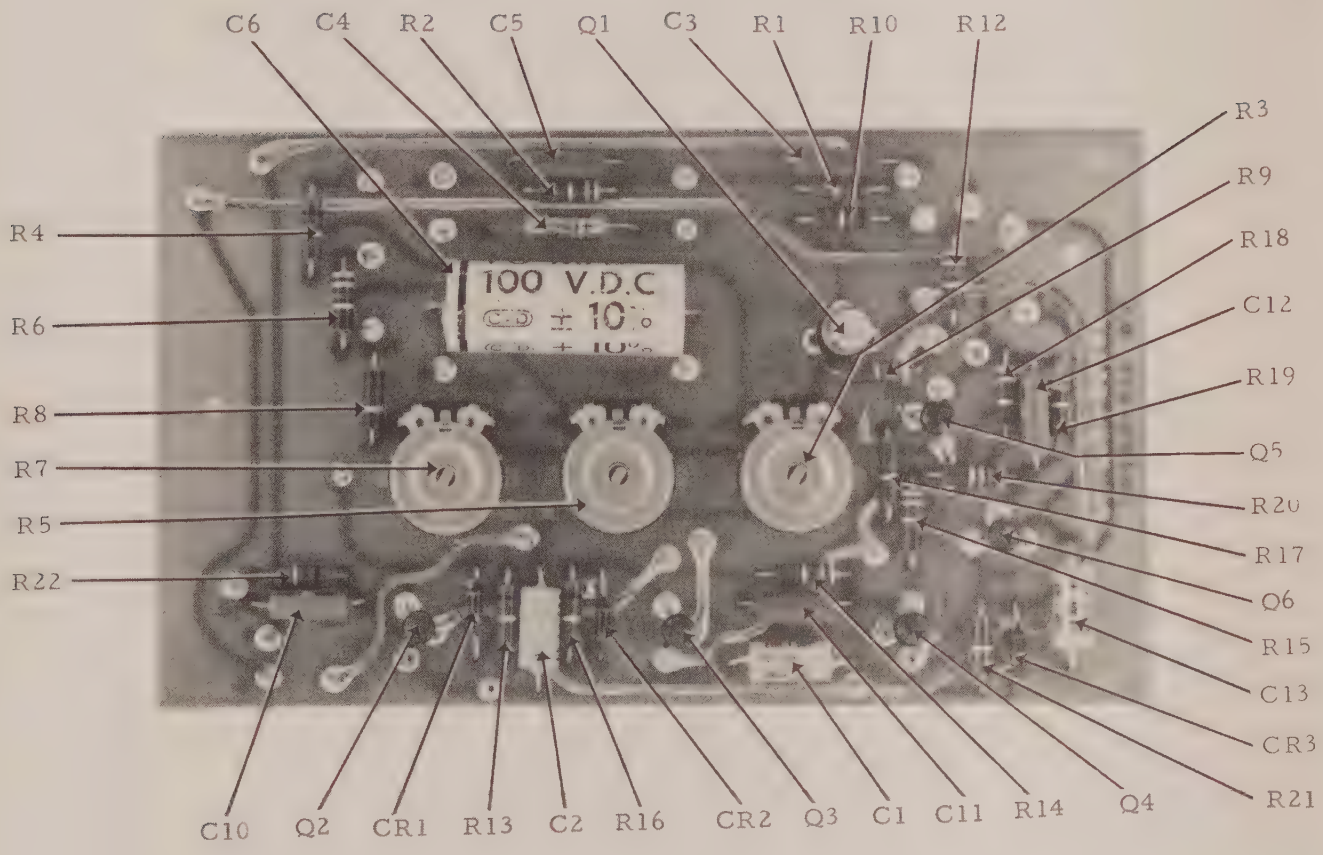


Figure 5-2. P902 Output Unit (left side).

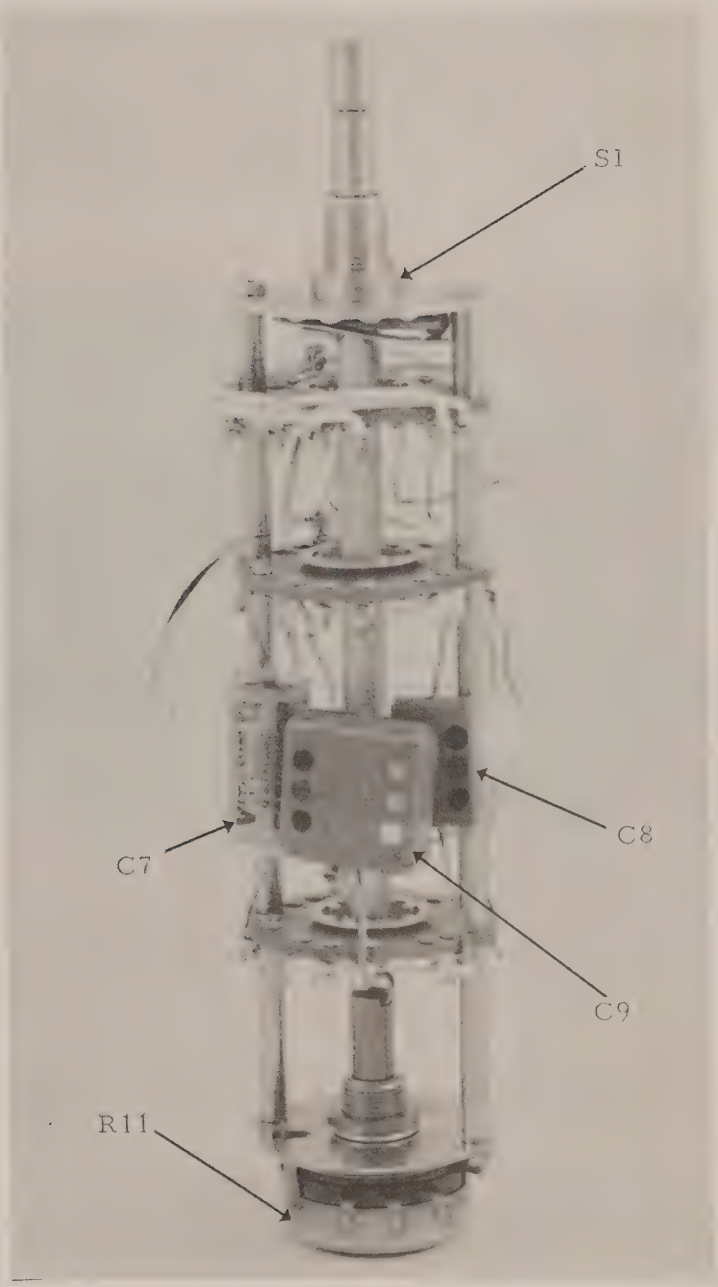
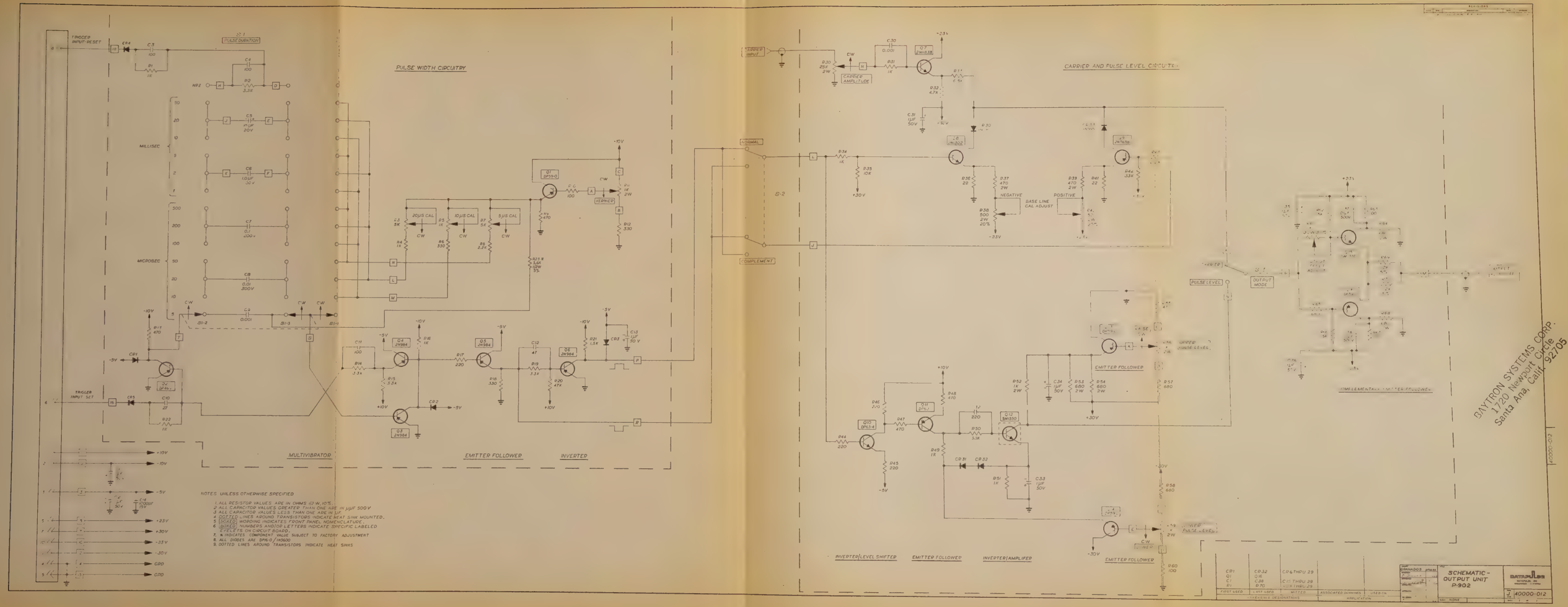


Figure 5-3. P902 Output Unit Pulse Duration Switch.



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ADDENDA AND ERRATA

E. O. NO.	EFFECTIVE DATE	DWG. NO.	CHANGE
2072	8-5-66	Manual	Maintenance Instruction, Section IV, Page 4-6, Paragraph 4.4.1.1, Line 11: 1. Change "Verify a negative pulse..." to "Verify a positive pulse..." 2. Same paragraph, line 15: Change "Verify two successive positive pulse..." to "Verify two successive negative pulse..."
2021	8-26-66	Transistor Equiv.	SM 1330 P/N 12685-004 is an acceptable substitute for DP63-6, P/N 22635-006.
2081	8-26-66	Transistor Substitution	2N2102 P/N 12685-005 may be used in lieu of 2N2270 P/N 12695-001.
2099	9-13-66		Change calibration procedure from -5 volts to -6 volts.
2227	3-16-67	Manual Operation & Maintenance	Make the following changes: 1. Page 1-1, Para. 1.3, add an asterisk (*) after -5V. 2. Page 4-3 Para. 4.3.3, add to 4th subparagraph an asterisk (*) and a foot note as follows: "5μs range is adjusted by selection of R23 nominally 3.6k and physically located on the back of the last wafer of the pulse duration switch." 3. Page 4-6, Paragraph 4.4.1, Line 8, add after sentence "set pulse delay.... vernier ccw." For models 103M and 202M only. 4. Para. 4.4.1.1, Line 8, add after "set pulse delay....zero delay switch)" for models 103M and 202M only. 5. Add after Item 2 of this E.O. the following: "Beyond 5 μs range calibration is adjusted by R7.
2256	5-2-67	J40000-012A L/M37000-036	Schematic Change R63 & 67 from 100Ω, 1/2W, 5%, A-B, P/N 10021-101 to 100Ω, 1/2W, 5%, Corning Glass, P/N 10721-101

E. O. NO.	EFFECTIVE DATE	DWG. NO.	CHANGE
2306	6-22-67	40000-012	Schematic - Output Change transistor symbol of Q7 from NPN to PNP (Change arrow from circumference to base).
2367	11-13-67	SB1-65	Transistor 2N2369A, P/N 22635-003 is an acceptable substitute for DP63-4, P/N 22635-004.
2911	2-27-70	40000-012	Schematic - Output Change Q3, Q4, Q5, and Q6 from 2N984, P/N 12435-002 to DP60-6, P/N 22605-006.
3217	11-23-70	40000-012	All DP601, P/N22605-001/0 may be substituted with DP608, P/N22605-008/0.
3820	2-21-72	40000-012	Change Q12 and Q15 from DP636, P/N22635-006 to JAN 2N2219A, P/N12645-002.
4028	7-24-72	40000-012	Change Q7 from RCA, 2N1183B, P/N12455-001 to 2N2904A, P/N12605-002.
4052	8-9-72	Manual	In Figure 5-2, reverse the polarity of capacitor C1. Schematic 40000-012 is ok.

DATAPULSE DIVISION
SYSTRON DONNER

SEMICONDUCTOR REPLACEMENTS

(Applicable to all Datapulse Models except the Model 102.)

SERVICE BULLETIN 1-65
Revised 8-13-73

The listed commercial diodes and transistors may be suitable replacements for the corresponding Datapulse parts, either as direct substitutes, or as selected for the special performance characteristics given. In certain cases, it may be necessary to use the Datapulse parts.

DATAPULSE TYPE NO.	DATAPULSE PART NO.	COMMERCIAL EQUIVALENT
Diodes:		
DP15-0	22154-000	1N752A selected for $\Delta V < 0.2$ V between 7 mA and 110 mA.
DP15-1	22154-001	Same as DP15-0 but matched in pairs to within 0.1 V.
DP15-201	22154-201	1N936 selected for 9.4 V $\pm$0.1 V @25 mA.
DP16-0	22164-000	1N3600
DP16-1	22164-001	(>80 V, DP16-0)
DP19-0	22194-000	1N2070/1N4005
DP19-6	22194-006	1N2071/1N4005
Transistors:		
DP46-1	22465-001	Selected for h_{fe} = 100 min.
DP59-0	22595-000	2N2904A
DP60-1	22605-001	2N2894 selected for V_{ceo} (sust) = 20 V min.
DP60-2	22605-002	2N3133
DP60-4	22605-004	2N3209
DP60-5	22605-005	FT1702
DP60-6	22605-006	2N3640
DP60-7	22605-007	2N2894 selected for V_{ceo} (sust) = 25 V
DP60-8	22605-008	2N2894A (Motorola) V_{ceo} >20
DP63-2	22635-002	Replaced by DP63-3
DP63-3	22635-003	2N2369A (Fairchild) h_{fe} >70
DP63-4	22635-004	Replaced by DP63-3
DP63-6	22635-006	2N2219A
DP63-8	22635-008	May be replaced by 2N5109 selected for $h_{fe} \geq 20$ @I_c = 0.25 A & V_c = 2.5 V
DP63-9	22635-009	May be replaced by 2N5109 selected for $h_{fe} \geq 20$ @I_c = 0.25 A & V_c = 2.5 V
DP64-0	22645-000	May be replaced by 2N5109 selected for $h_{fe} \geq 20$ @I_c = 0.25 A & V_c = 2.5 V

DATAPULSE DIVISION, SYSTRON-DONNER CORPORATION
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WARRANTY

The Datapulse Division, Systron-Donner Corporation (hereinafter referred to as Datapulse) warrants each instrument of its manufacture to be free from defects in material and workmanship. Our obligation under this Warranty is limited to servicing or adjusting any instrument returned to our factory for that purpose, and to making good at our factory any part or parts thereof except tubes, transistors, fuses or batteries which shall, within one year after making delivery to the original purchaser, be returned to us with transportation charges prepaid, and which our examination shall disclose to our satisfaction to have been thus defective.

Instruments returned under this Warranty will not be accepted at the Datapulse plant without prior authorization by a Datapulse representative or by the service manager of Datapulse.

Datapulse reserves the right to make changes in design at any time without incurring any obligation to install same on units previously purchased.

This Warranty is expressly in lieu of all other obligations or liabilities on the part of Datapulse and Datapulse neither assumes nor authorizes any other person to assume for them any other liability in connection with the sales of Datapulse instruments.

MP MASTER
MA28919